Week 3 Exercise on Arrays

Instructions: Each problem is framed as a real life scenario. Your goal is to first identify the underlying algorithmic pattern, then design an optimal solution.

1. Dominant Error Type in Production Logs

Story

A large distributed backend system records an error code every time a request fails. Over a long monitoring window, engineers believe that one particular error code is responsible for the majority of failures.

- The log stream is extremely large

- You can process entries only once

- Storing frequency counts for all error codes is not feasible

Example

errors = [500, 404, 500, 500, 403, 500, 500]

Task

Identify the error code that appears in more than half of the log entries.

2. Dominant Complaint Category

Story

A customer support system categorizes every complaint using a numeric category ID. Product

managers suspect that some complaint categories dominate user dissatisfaction.

- More than one category may be dominant

- A category is considered dominant if it appears in more than one third of complaints

- Memory usage must remain constant

Example

categories = [2, 1, 2, 3, 2, 1, 2, 2]

Task

Return all complaint categories that appear more than n/3 times.

3. Scam Keyword Surveillance

Story

A chat moderation pipeline tags every incoming message with a keyword ID. Certain keywords indicate scam attempts and may appear frequently.

- A keyword is suspicious if it appears more than n/k times

- The value of k is small and known

- You must avoid maintaining large frequency tables

Example

keywords = [7, 3, 7, 2, 7, 3, 7, 5], k = 4

Task

Identify all suspicious keyword IDs.

4. Best Streak of Audience Engagement

Story

You run an online learning platform or YouTube channel. Every day, you track net audience engagement change.

- +ve values indicate growth in subscribers or watch time

- -ve values indicate drop in engagement

Example

engagement = [-50, +120, -30, +200, -20, +100, -300]

Task

Find the continuous time window that yields the maximum total engagement.

5. Circular Delivery Route Profit

Story

A delivery rider travels a circular route around the city. At each stop, the rider either earns or loses money.

- The route forms a closed loop

- The rider may start at any stop

- The rider must travel through consecutive stops

Example

profit = [8, -4, 3, -5, 4]

Task

Determine the maximum profit achievable from a continuous ride.

6. Ignore One Bad Analytics Day

Story

A startup tracks daily growth metrics. Occasionally, a severe outage produces an abnormally bad data point.

- You may ignore at most one day

- The selected period must remain non empty

Example

growth = [1, -2, 0, 3]

Task

Compute the maximum possible growth over any continuous period.

7. Growth Multiplier Streak

Story

A finance dashboard logs daily growth multipliers. Negative multipliers represent losses.

- Multipliers may be positive, negative, or zero

- The effect compounds multiplicatively

Example

multipliers = [2, 3, -2, 4]

Task

Find the contiguous streak with the maximum compounded growth.

8. Laundry Segregation System

Story

A smart washing machine outputs clothes labeled by color category.

- 0 represents Whites

- 1 represents Colors

- 2 represents Dark clothes

Example

clothes = [2, 0, 2, 1, 1, 0]

Task

Reorder the clothes so that similar categories are grouped together in a single pass.

9. Traffic Severity Reordering

Story

A traffic monitoring system labels events by severity level.

- Low severity

- Medium severity

- High severity

Example

severity = [1, 0, 2, 1, 0, 2]

Task

Reorder the events so that severities are grouped efficiently.

10. On Call Roster Rotation

Story

A company rotates its on call engineer schedule every week.

- Rotation happens to the right

- The operation must be done in place

Example

roster = [A, B, C, D, E], k = 2

Task

Rotate the roster according to the schedule.

11. Zero Impact Event Cleanup

Story

System logs contain zero impact events that add no value to analytics.

- Zero impact events must be moved to the end

- The order of other events must be preserved

Example

events = [1, 0, 3, 0, 5]

Task

Rearrange the log entries accordingly.

12. Fixed Length Campaign Analysis

Story

A marketing team analyzes campaign performance over fixed length windows.

- The window size is fixed

- Windows must be contiguous

Example

performance = [2, 1, 5, 1, 3, 2], k = 3

Task

Find the window with the maximum total performance.

13. Longest Focus Time Without Distraction

Story

A productivity app logs a user’s focus state throughout the day.

- F represents focused time

- D represents distracted time

Example

states = [F, F, F, D, F, F, D, F]

Task

Determine the longest continuous interval with at most one distraction.

14. Longest Unique Session Trace

Story

An application records event IDs during a user session.

- Repeated event IDs indicate redundant operations

- You want the longest segment with no repeats

Example

trace = [A, B, C, A, D, E]

Task

Find the length of the longest valid session segment.

15. Transaction Window Equals Target

Story

A financial ledger records transaction deltas over time.

- Transactions may be positive or negative

- Order of transactions matters

Example

transactions = [3, 4, -2, 5, -3], target = 7

Task

Determine whether a contiguous window sums exactly to the target value.

16. Subscription Credit Usage

Story

A subscription trial allows users to spend credits continuously.

- Credits used per action are always positive

- Total credits used must not exceed the limit

Example

credits = [2, 1, 3, 2, 1], limit = 5

Task

Find the longest continuous usage streak within the limit.